CLAIMS

1. A method of plating for filling via holes, in which each of via holes formed in an insulation layer covering a substrate so as to expose, at its bottom, part of a conductor layer located on the substrate, is plated with copper to be filled with the plated metal, the method comprising the steps of:

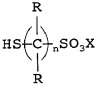
forming a copper film on the top surface of the insulation layer covering the substrate, and the side walls and bottoms of the respective via holes,

immersing the substrate having the copper film formed in an aqueous solution containing a plating promoter to thereby deposit the plating promoter on the surface of the copper film,

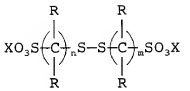
removing the plating promoter from the surface of the copper film located on the insulation layer and leaving the plating promoter on the side walls and bottoms of the respective via holes, and

electroplating the substrate having the copper film formed with copper to thereby fill the via holes with the plated copper and simultaneously form a continuous copper film which eventually covers the via holes filled with the plated copper as well as the copper film previously formed on the insulation layer.

2. The method of claim 2, wherein, as the plating promoter, a sulfur compound or a mixtures of sulfur compounds is used, the sulfur compound being selected from the group consisting of the compounds represented by the general formulae:



and



wherein X denotes sodium, potassium, or hydrogen, R denotes hydrogen or an alkyl group, n is an integer of one or larger, and m is an integer of one or larger.

3. The method of claim 2, wherein the sulfur compound is selected from the group consisting of sodium 3-mercapto-1-propanesulfonate, sodium 2-mercaptoethanesulfonate, and disodium bis-(3-sulfopropyl)-disulfide.

4. The method of claim 1, wherein the aqueous solution containing the plating promoter further comprises a non-ionic surfactant.

5. The method of claim 4, wherein the non-ionic surfactant is a polyethylene glycol or polypropylene glycol.

6. The method of claim 1, wherein the plating promoter is removed by a process or treatment selected from the group of (1) an etching process using an etching solution for copper, (2) a cyanide electrolytic treatment using a cyanide electrolytic bath, (3) a ultraviolet radiation treatment obliquely irradiating the surface of the copper film on the insulation layer with ultraviolet radiation, and (4) a treatment of polishing the surface of the copper film on the top of the insulation layer.

7. The method of claim 1, wherein the step of removal of the plating promoter is omitted and, after the step of immersion of the substrate in the plating promoter-containing solution, a reverse electrolytic treatment is performed at an early stage of the step of electroplating with copper.

8. The method of claim 1, wherein the step of removal of the plating promoter is omitted and, after the step of immersion of the substrate in the plating promoter-containing solution, a pulse plating in which

the direction of current applied is periodically reversed is used in the step of electroplating with copper.

9. The method of claim 1, wherein the step of electroplating with copper is carried out by the use of an electroplating solution free of a plating promoter.

10. The method of claim 1, wherein the step of immersion of the substrate in the plating promoter-containing solution is carried out using, as the plating promoter, sodium 3-mercapto-1-propanesulfonate or sodium 2-mercaptoethanesulfonate, the step of removal of the plating promoter is omitted, and the step of electroplating with copper is carried out using an electroplating solution free of a plating promoter.

11. The method of claim 1, wherein, prior to the step of immersion of the substrate in the plating promoter-containing solution, a strike plating of copper is provided on the surface of the copper film.